Rice University
Civil and Environmental Engineering

CEVE 420/520 – ENVIRONMENTAL REMEDIATION AND RESTORATION

FALL 2012 Syllabus

Course objective

The objective of this class is to provide you with the knowledge of chemicals, technologies, and institutional considerations that you need to select an appropriate method for cleaning up contaminated soil, groundwater, sediment, and surface water.

Textbooks

There is no textbook for this class, but I will give you technical papers, book extracts, and reading assignments from books that I put on reserve in the library throughout the semeseter.

Grading

Exams (2)	40%
Homework	20%
Report	20%
Final	20%

Exams

Two closed-book exams will be given in class. The first exam is tentatively scheduled for October 1, and the second is tentatively scheduled for November 5. Both exams will be mostly qualitative with short answers to test your knowledge of specific issues and your understanding of key concepts. There will also be some brief quantitative exam questions to make sure that you know how to apply some of the principles taught.

The final exam will be comprehensive and similar to the first two exams.

Homework

Homework assignments will generally be due 1 to 2 weeks after distribution. Assignments and solutions will be posted on Owlspace. Grades on late homework assignments will be reduced by 10 percent of the possible homework grade for each day or part of day that they are late. Extensions can be given *with prior arrangement*.

Report

Each student will prepare a design report on a key topic covered in the class. The report will consist of a conceptual design of a site remediation project. Key elements of the report will include:

- A background section explaining the issue and technical approach;
- How cleanup levels were established;
- A description of the technology selection process;
- A detailed description of the selected technology;
- A preliminary conceptual design, in the form of text and rough drawings, that illustrate the major design components;
- Calculations to support estimates of materials, labor, and capital needs as well as technical performance;
- A preliminary cost estimate and schedule.

Field trip to Industrial Site

We will take a field trip to an industrial site to see monitoring wells and see active groundwater extraction systems. The trip is tentatively scheduled for late October or after the first cold front passes through, but the date is subject to change based on student commitments, weather, and plant activities.

Instructor and Office Hours

Phillip C. de Blanc, Ph.D., P.E.
Lecturer in Civil and Environmental Engineering
262 Mech Lab
Phone: 713-348-4725
Mobile: 281-635-6069 (Emergencies only please!)
Email: pcdeblanc@rice.edu

Office hours 10:00 to 11 a.m. MWF and by appointment.

I check email regularly, and you are encouraged to communicate by email whenever possible. I will usually respond within a few hours, but never more than 24 hours later.

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1. Introduction
    a. Why clean up the environment?
    b. Sources and Extent of Chemical Contamination in the U.S. and World
    c. Types of sites
    d. Types of Media Affected with examples
    e. Classes of chemical contaminants
    f. Physical nature of contaminants (dissolved, NAPLs, etc.)
2. Site Investigation
    a. Objectives – ID nature, magnitude, and extent of impacts
    b. Conceptual model
    c. Preliminary assessment
    d. Field investigation techniques
    e. Field testing techniques (slug tests, pumping tests, tracer tests)
    f. Laboratory analyses
    g. Assessing extent of impacted media (interpolation techniques, etc.)
3. Risk Assessment
    a. Fundamentals – dose, pathways
    b. Carcinogenic and non-carcinogenic risk considerations
    c. Forward calculations – determining risk from a site.
    d. Backward calculations – calculating cleanup levels
    e. Statistical methods for cleanup
4. Chemical and Physical Properties Affecting Remediation Technologies
    a. Media Characteristics
    b. Chemical Characteristics
    c. Institutional
5. Remediation objectives and classification of technologies
    a. Remediation Objectives
    b. Classification of Remediation Technologies
6. Technologies for Soil Remediation
7. Technologies for Groundwater Remediation
    a. Groundwater extraction
    b. Ex-situ groundwater treatment
    c. In-situ groundwater treatment
    d. Containment
8. Selection of remedial alternatives
    a. Sources of information on remediation technologies
    b. Factors to consider
    c. Presumptive remedies
    d. Technology evaluation
    e. Assembling technologies into complete alternatives
    f. Criteria for evaluation of alternatives
9. Remediation Design Elements
    a. Treatability testing
    b. Supplementary investigations
    c. Design

   d. Use of models
   e. Cost Optimization
   f. Long-term monitoring
   g. Sustainability
10. Surface Water and Sediment Restoration

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Day	Date	Week	Number	Subject	Reading/Assign	Hand-Outs/Props/Case Studies
Mon	20-Aug	1	1	First Day of Class Introduction		
Wed	22-Aug	1	2	Site Investigations		
Mon	27-Aug	2	3	Site Investigations Guest Lecture – Site Investigation Field Techniques		
Wed	29-Aug	2	4	Risk Assessment		
Mon	**3-Sep**	**3**		**Labor Day - No Class**		
Wed	5-Sep	3	5	Chemical, Physical Properties		
Mon	10-Sep	4	6	Soil remediation		
Wed	12-Sep	4	7	Classes of remediation technologies Guest Lecture – Risk Assessment		
Mon	17-Sep	5	8	Soil remediation technologies		
Wed	19-Sep	5	9	Soil remediation technologies		
Mon	24-Sep	6	10	Soil remediation technologies		
Wed	26-Sep	6	11	Focus: soil vapor extraction Guest Lecture – SVE system design		
Mon	1-Oct	7	12	Exam No. 1		
Wed	3-Oct	7	13	Groundwater remediation		
Mon	**8-Oct**	**8**		**No Class**		
Wed	10-Oct	8	14	Groundwater remediation technologies		

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Mon	15-Oct	9	15	Groundwater remediation technologies		
Wed	17-Oct	9	16	Groundwater remediation technologies		
Mon	22-Oct	10	17	Focus: engineered bioremediation Guest Lecture – In-Situ Bio Design		
Wed	24-Oct	10	18	Selection of remedial technologies		
Mon	29-Oct	11	19	Remediation design elements		
Wed	31-Oct	11	20	Field Trip to GBB		
Mon	5-Nov	12	21	Exam No. 2		
Wed	7-Nov	12	22	Surface water resources (Bedient)		
Mon	12-Nov	13	23	Surface Water/Sediments (Bedient)		
Wed	14-Nov	13	24	River restoration (Bedient)		
Mon	19-Nov	14	25	River restoration (Bedient)		
Wed	21-Nov	14	26	Low impact development (Bedient)		
Mon	26-Nov	15	27	Low impact development (Bedient)		
Wed	28-Nov	15	28	Last day of class (open)		